# Electromagnetic compatibility

# Make your system comfortable

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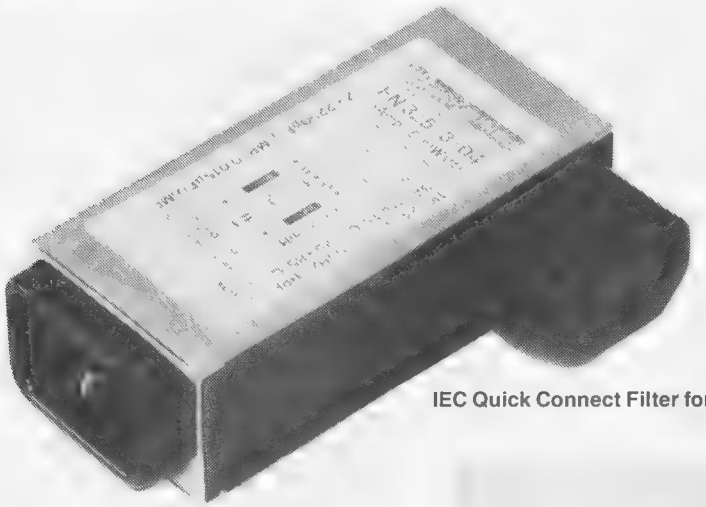


**IEC Quick Connect Filter for Service Work.**

## SUPPRESSION MEASURES

The most cost-effective means of attenuating an interfering signal are those steps taken in the design phase of a project. Later, so-called "improvements" may be at least very expensive and, in some cases, impossible to achieve.

Increasing environmental pollution caused by solid, liquid and gaseous waste is readily perceived by the human senses. Environmental contamination by electromagnetic energy also is steadily increasing but, as the human senses are not attuned to perception of this energy, the pollution is less obvious. Man-made electric systems, which are designed to operate within the electromagnetic environment, suffer the most harm from electromagnetic pollution.

The expression "electromagnetic compatibility" (EMC) defines the capability of electronic equipment or systems to be operated in the intended electromagnetic environment at design levels of efficiency. This article reviews some of the more frequent hazards to EMC.

## INTERFERENCE SOURCES

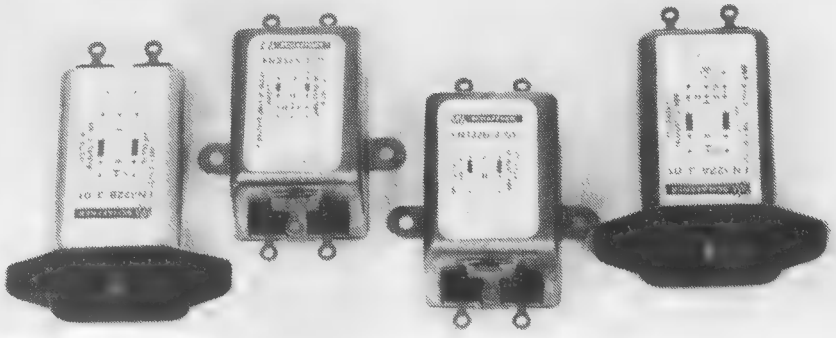
Quite frequently, designers of electronic and computer control systems ignore the very harsh environmental conditions commonly found in heavy industry. Unless protective measures are taken, erratic operation of the hardware systems — even total failure — can result.

Four fundamental interference sources are:

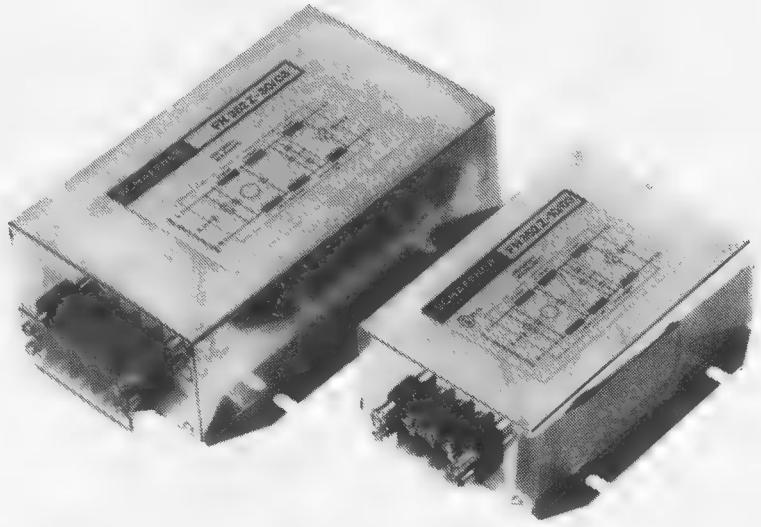
* man-made noise (from electrical consumers);
* electro-mechanical pulses through nuclear reaction;
* atmospheric events (from lightning, electrostatic discharges); and
* cosmic noise.

## SUSCEPTIBILITY

Since the control system designer has little control over the environment in which his equipment will be working, it is important that he should determine to what degree the equipment is susceptible to interference. Levels of susceptibility often are determined both against erratic operation and against total failure of hardware. For this purpose, special test equipment (such as the Schaffner range supplied by Westinghouse Systems) is available for pulse, high voltage and other simulation testing of process control and electronic equipment.



**Variety of Power Line Filters from one Amp to 10 Amps.**



**A Very High Performance Filter with Surge Protection. Maximum Current 30 Amps.**

Many methods of suppression are available t the designer. These include:

* the use of optocouplers, isolation transformers, twisting conductors, fibre optics; suitable power line or signal line filters;
* separation of wiring; shielding;
* EMC hardened design of system, including the design of printed circuit boards; and
* impediment of electrostatic charges (by increasing air humidity; or by use of conductive working surfaces, for example).

## FILTER SELECTION

When a filter is required, further factors need the designer's consideration.

How much insertion loss will be required over the frequency range of interest? Often, the high attenuation, a multiple-stage filter must be used. Where a switch-mode power supply is involved, very high loss at lower frequencies is important.

It is important, too, to match the power supply current-rating of a filter to that of the equipment: when a switch-mode power supply is used, it is essential to consider that peak currents often are 10 times the average current. For this reason, the system requires filter chokes which will not saturate when such conditions arise.

A filter with an earth line choke must be specified when the conducted interference is asymmetrical.

It is also possible to absorb the very high energy of power supply voltage spikes by transient voltage suppression. Some filters have such suppressers fitted.

Finally, the wide range of filter sizes can be considered. These vary between filters suitable for an entire cabinet of equipment and, compact units which combine an IEC power connector, fuses and switch. Schaffner filters, from Westinghouse Systems, are available to suit all applications.

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# THE HAPLESS AMATEUR

## a true story of the 1988 John Moyle Memorial Field Day Contest

As always, I enjoyed the contest and, as always, something happened to make it a little different. Last year I flattened my battery and, after some pushing and grunting, finished with the car at the bottom of a hill with nowhere to go, the engine not running and the battery still very flat.

This year I took along two extra batteries and, just as I was about to commence operations, two Four Wheel Drive vehicles drew up on the opposite peak at Mount Fatigue and the occupants proceeded to erect an antenna. Arrrh bother, another field day operator on the same site and lots of QRM! But no, it was Col VK3BLE, and assistants erecting the antenna for a CB UHF repeater. Phew!

But then, at lunchtime, about 12 horsemen (and horsewomen and horsechildren) accompanied by several dogs appeared out of the bush and made straight for the disused CFA tower that I had selected to fix my antennas to. It was quickly apparent to the head horseman that I was in their way, "Them wires are in the horses way" he observed in a meaningful manner. "Well, someone has a problem," I retorted and, looking up at the milling posse, decided on positive action. "I'll move them in a moment" I said.

So, concluding the QSO I had been engaged in, I rolled up the radials for the 10 metre-high vertical. I decided to leave the three lengths of coax on the ground and chance any damage from the horses hooves. Likewise, especially as the horses were now tethered all around me, it seemed wise to leave the rest of the antenna farm (a dipole and two metre vertical) where it was and return to the rig and hope that none of the horses were inclined to kick. Fortunately, they seemed satisfied merely to graze and leave the occasional calling card where I might find it when packing up.

It was about this time that two of the dogs took a violent dislike to each other and it was only good luck that they chose to do most of their fighting on the far side of my car, rather than beside the batteries and card table on which the station sat; and where they had previously been lying.

Nevertheless, I had several anxious moments as they stood either side of my set-up expressing contempt for each other before returning to the fray.

When several bikies, a pair of pensioners and a honeymoon couple also joined the crowd I realised that I was not really as far out in the bush as I had thought.

In due course, some of the horseriders cautiously engaged me in conversation and within a few minutes a friendly discussion on horses and amateur radio was underway. Some strong, clear signals from Japan impressed the younger members of the group and I regretted not having some WIA information sheets on hand.

After about an hour they saddled up and I was left one again to the tranquillity of the mountain top.

—The experiences of Ron Cook VK3AFW, contributed by Frank Beech VK7BC

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